Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

June 29, 2016
NOC-AE-16003386
10 CFR 50.73

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

South Texas Project
Unit 1
Docket No. STN 50-498
Licensee Event Report 2016-002-00
Unit 1 Automatic Reactor Trip and Auxiliary Feedwater System Actuation
Following Turbine Trip due to Generator Lockout

Pursuant to 10 CFR 50.73(a)(2)(iv)(A), STP Nuclear Operating Company (STPNOC) hereby submits the attached South Texas Project (STP) Unit 1 Licensee Event Report (LER) 2016-002-00 for a valid automatic actuation of the Reactor Protection System and for a valid automatic actuation of the Auxiliary Feedwater System.

The event was of very low risk significance and no radioactive release occurred; therefore, there was no adverse effect on the health and safety of the public.

There are no commitments in this letter.

If there are any questions, please contact Wendy Brost at (361) 972-8516 or me at (361) 972-7344.

James Connolly
Site Vice President

web

Attachment: Unit 1 LER 2016-002-00

IE22
NRR

STI: 34332298

cc:
(paper copy)

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
1600 East Lamar Boulevard
Arlington, TX 76011-4511

Lisa M. Regner
Senior Project Manager
U.S. Nuclear Regulatory Commission
One White Flint North (O8H04)
11555 Rockville Pike
Rockville, MD 20852

NRC Resident Inspector
U. S. Nuclear Regulatory Commission
P. O. Box 289, Mail Code: MN116
Wadsworth, TX 77483

(electronic copy)

Morgan, Lewis & Bockius LLP
Steve Frantz, Esquire

U.S. Nuclear Regulatory Commission
Lisa M. Regner

NRG South Texas LP
Chris O'Hara
Jim von Suskil
Skip Zahn

CPS Energy
Kevin Pollo
Cris Eugster
L. D. Blaylock

Crain Caton & James, P.C.
Peter Nemeth

City of Austin
Elaina Ball
John Wester

Texas Dept. of State Health Services
Richard A. Ratliff
Robert Free

NRC FORM 366 (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
South Texas Unit 1	05000498	1 OF 5

4. TITLE

Unit 1 Automatic Reactor Trip and Auxiliary Feedwater System Actuation Following Turbine Trip due to Generator Lockout

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	N/A
05	01	2016	2016	002	00	06	29	2016	FACILITY NAME: N/A	DOCKET NUMBER: N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
100%	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Wendy Brost, Licensing Engineer	(361) 972-8516

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	TB	BDUC	G080	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On May 1, 2016 at 2020 hours, STP Unit 1 experienced a Main Generator lockout due to a ground relay actuation resulting in an automatic turbine trip that lead to an automatic reactor trip. Visual inspections revealed that a rubber boot located where Main Generator phase B enters the isolated phase bus duct was degraded. A piece of the boot was hanging down and intermittently contacting the generator bushing causing a resistance path to ground, resulting in a Main Generator lockout and turbine trip signal. With the reactor at greater than fifty percent power, the automatic reactor trip was initiated in response to the turbine trip. The Auxiliary Feedwater (AFW) system actuated in response to low Steam Generator level. All safety systems operated as expected.

As immediate corrective actions, the A, B and C phase rubber boots were replaced in Unit 1. The cause evaluation determined that the design of the rubber boot and its retaining ring is inadequate. Design change packages are being developed to permanently remove the rubber boots and retaining rings for both Unit 1 and Unit 2.

The automatic actuation of the Reactor Protection System and automatic AFW actuation are both reportable under 10 CFR 50.73(a)(2)(iv)(A). The event was of very low risk significance and no radioactive release occurred; therefore, there was no adverse effect on the health and safety of the public.

LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
South Texas Unit 1	05000498	2016	002	00

NARRATIVE

I. Description of reportable event

A. Reportable event classification

This event is reportable under §50.73(a)(2)(iv)(A) as an event or condition that resulted in an automatic actuation of the Reactor Protection System and also as an event or condition that resulted in an automatic actuation of the Auxiliary Feedwater (AFW) system.

B. Plant operating conditions prior to event

Prior to the event on May 1, 2016, Unit 1 was operating in Mode 1 at 100 percent power.

C. Status of structures, systems, and components (SSCs) that were inoperable at the start of the event and that contributed to the event

There were no SSCs that were inoperable at the start of the event that contributed to the event.

D. Narrative summary of the event

On May 1, 2016 at 2020 hours, STP Unit 1 experienced a Main Generator lockout caused by a ground relay actuation, resulting in an automatic turbine trip which led to an automatic reactor trip.

Approximately 14 seconds later, an initiating signal for feedwater isolation was received due to low average Reactor Coolant System (RCS) temperature coincident with a reactor trip.

At 2024 hours, the AFW system actuated due to low Steam Generator (SG) level.

Following the automatic reactor trip, Unit 1 stabilized in Mode 3 (Hot Standby) at normal operating pressure and temperature. All Control Rods fully inserted, no primary or secondary relief valves opened, and there were no electrical problems. Unit 2 was not affected.

E. Method of discovery

The automatic reactor trip and AFW actuation were self-revealing. The automatic turbine trip occurred upon receipt of the Main Generator lockout signal. With the reactor at greater than fifty percent power, the automatic reactor trip was initiated in response to the turbine trip. The AFW system actuated automatically on a SG low level signal approximately 4 minutes and 10 seconds following the reactor trip.

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NARRATIVE

II. Component failures

A. Failure mode, mechanism, and effects of failed component

The failed component was a neoprene rubber boot installed between the Main Generator B phase and the isolated phase bus duct.

The failure of the rubber boot occurred due to heat aging that caused the material to degrade and become hardened and brittle to such an extent that it carbonized and became partially conductive at voltages above 2 kV. Due to the design of the boot and its metal retaining ring, heat was concentrated on the rubber in a band approximately one inch above the bottom edge of the rubber boot, causing a piece of the boot below the generator to become loose. The loose rubber piece made intermittent contact with the Main Generator bushing causing a resistance pathway to ground. This condition resulted in a Main Generator lockout actuation and subsequent automatic turbine trip leading to an automatic reactor trip.

B. Cause of component failure

The cause of the component failure was determined to be an inadequate design for the rubber boot and retaining ring between the Main Generator and isolated phase bus duct. The cause evaluation also concluded that permanent removal of the rubber boot and associated clamps and retaining ring will not impact the system functionality. The A, B and C phase rubber boots were replaced in Unit 1 and are planned to be removed during the next Unit 1 refueling outage.

C. Systems or secondary functions that were affected by failure of components with multiple functions

The rubber boot between the Main Generator phase B and the isolated phase bus duct does not have multiple functions that affect other systems.

D. Failed component information (Energy Industry Identification System (EIIS) designators provided in {brackets})

Main Generator System {TB}
Neoprene rubber boot
Manufacturer: General Electric Canada {G080}

III. Analysis of the event

A. Safety system responses that occurred

The Reactor Protection System and AFW systems both responded to this event.

B. Duration of safety system inoperability

There were no SSCs that were inoperable at the start of the event that contributed to the event.

C. Safety consequences and implications

No Technical Specification Limiting Conditions for Operation (LCOs) were entered due to this event. The turbine automatically tripped following receipt of the generator lockout signal. Subsequently, the automatic turbine trip led to an automatic reactor trip.

For the Probabilistic Risk Assessment (PRA) analysis, the initiating event is classified as a Turbine Trip (TTRIP). No risk significant equipment was out of service at the time of the event and all fission product barriers remained intact.

The STP PRA was used to estimate the relevant metrics for this event, Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP), given the TTRIP actually occurred. The CCDP and CLERP were determined to be 6.14E-07 and 3.62E-08 respectively, indicating very low risk significance.

The event was of very low risk significance and no radioactive release occurred; therefore, there was no adverse effect on the health and safety of the public.

IV. Cause of the event

The event was caused by a loose piece of the degraded rubber boot that intermittently contacted the Main Generator bushing causing a resistance path to ground and forming an electrical path between the bus and ground. This caused the Main Generator lockout relay to actuate which resulted in an automatic trip of the Unit 1 turbine which led to an automatic reactor trip. The AFW system actuated automatically on low SG level following a Feedwater isolation due to low average reactor temperature.

V. Corrective actions

The neoprene rubber boots between the Main Generator phase A, B and C and the isolated phase bus duct were replaced and associated Post Maintenance Tests were performed.

Additionally, design changes will be developed and implemented to remove the rubber boots and associated clamps and retaining rings for both Unit 1 and Unit 2.

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NARRATIVE

VI. Previous similar events

An operating experience (OE) review was conducted as part of the cause evaluation performed for this event. No OE was found related to rubber boot material degrading in the area between the Main Generator and the isolated phase bus duct.

There have been no STP Licensee Event Reports related to a reactor trip due to a Main Generator lockout submitted within the last three years. In 2011, Unit 2 experienced a reactor trip due to a Main Generator lockout (LER 2-2011-002), however, this event was initiated by Stator Cooling Water leakage from one the water cooled stator coils in the generator.